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On a System of Controlling a Wind Tunnel by Means of a Mini-Computer

By Yasuharu NAKAMURA, Jun-ichi OKABE, Sadatoshi TANEDA, Atsushi OKAJIMA, Masayuki OIKAWA and Nobutaka FUKAMACHI

The characteristics of instruments used for a system of controlling a wind tunnel by means of a mini-computer are described and the programs developed for the system are presented. The of various characteristics of the wind tunnel operated by this system are also presented.

Numerical Simulation of Buoy Dynamics by Lumped Mass Method.

By Wataru KOTERAYAMA, Tomoki NAGAHAMA and Hideo ISHII

Motions of oceanographic research buoys and their rope tensions in states of deployment, mooring in an unsteady current or regular waves and retrieval were calculated by using lumped mass method. The results were compared with those of model experiments and field measurements.

Fluid Characteristics of a Pair of Circular Cylinders Normal to a Uniform Flow at Very High Reynolds Numbers

By Atsushi OKAJIMA and Ken'ichiro SUGITANI

Important problems were left unsolved about fluid characteristics of a pair of circular cylinders normal to a uniform flow at higher Reynolds numbers than the critical one, due to the difficulties of experiments. In this study, I succeed in measurements of distributions of pressures and velocities, drag and lift forces, Strouhal number and the phases of fluctuating velocities of the cylinder pair over the critical Reynolds number, up to 4.5×10^5.

Flow behaviour near surfaces of cylinders were observed by means of the visualization techniques, the oil-film and the tufts methods.

It became clear as follows;

(i) There could not be distinguished a difference of the values of critical Reynolds numbers between a pair of cylinders and a single cylinder.

(ii) In the subcritical region, it was confirmed that the movement of the stagnation point due to the proximity of the other cylinder rotated the resultant force vector thus giving a component in the lift direction.

(iii) In the supercritical region where there could be observed laminar bubbles on the surfaces, asymmetries in the flow around cylinders due to a single asymmetric laminar bubble produced large lift force; the cylinder with a single laminar bubble was experiencing lift force 2 or 3 times as much as drag force for the generated laminar bubble was accompanied with extremely low pressure.

(iv) Even in the supercritical region, where there generated a single laminar bubble on each outside surface, symmetrical flow was not realized due to the flow through the gap attaching itself more to one cylinder than the other.

(v) On wake behind a pair of cylinders in the supercritical region, vortices were shed in the form of two vortex streets with each different Strouhal number when the gap was wide. However, when the cylinders were nearly touching, vortex shedding was detected with only one sheet forming, for the phase angle between two fluctuating velocities across the cylinder pair was exactly 180°. The Strouhal number was low, its value being almost 0. 1.

Flows around Rectangular Cylinders

—Measurements of Strouhal numbers and base pressures in the range of Reynolds numbers from 10^2 to 10^4—

By Atsushi OKAJIMA and Ken'ichiro SUGITANI

Effects of Reynolds number on the Strouhal number and the pressure of rectangular cylinder are discussed from the results of experiments conducted in both wind tunnel and water tank.

The present range of Reynolds numbers is between 10^2 and 10^4, where there occurs the transition from laminar to turbulent flow near a cylinder.

There were, however, insufficient data in literature.

It becomes clear, here, that the values of Strouhal number and the distributions of presure are considerably influenced by Reynolds number as well as the side ratio of a rectangular cylinder;

(i) The values of Strouhal number of a cylinder with a square section, are almost constant and its base pressure abruptly drops in the range of Reynolds numbers over 10^3.

(ii) The values of Strouhal number of a rectangular cylinder with a side ratio 2 are suddenly changed beyond Reynolds numbers of Re=450 to 500, while any discontinuous changes cannot be found in its base pressure.

(iii) In the values of Strouhal number and the base pressure of a rectangular cylinder with a large side ratio 3, there occurs a distinctly discontinuous change in the wide range of Reynolds numbers between 900 and 3000, where it is clearly observed that laminar flow pattern intermittently alternates with turbulent one.

(iv) In the case of a rectangular cylinder with the largest side ratio 4, Strouhal number remains nearly constant and the pressure, the distribution of which has a shape peculiar to laminar flow, gradually diminishes for Reynolds number lower than 1000.

Finally, it may be concluded that Reynolds number is a more important factor than the side ratio.